

Message

From: SWMM-USERS [SWMM-USERS@LISTSERV.UOGUELPH.CA]
on behalf of Robert Dickinson **Ex. 6 Personal Privacy (PP)**
Sent: 3/28/2019 3:23:45 PM
To: SWMM-USERS@LISTSERV.UOGUELPH.CA
Subject: [SWMM-USERS] TSS simulation

Hello Jiada, You probably should ask your PySWMM questions on OWA or at least in your question here specify if the question is ONLY for PySWMM or a combination of PySWMM and the EPA SWMM 5 output. You can see the variables in the SWMM5 output by using SWMM 5 and viewing the output parameters. Or if you want to just use the C code see enums.h which also lists the output variables.

Here is the output variables from enums.h for nodes and links, You multiply LINK_FLOW * LINK_QUAL for example to get the load in the link, I hope this is helping. If I may offer a suggestion, please try to understand all the the output in the SWMM 5 GUI before programming in Python. It might als help if you add to PySWMM so that it has the same report features as the SWMM 5 GUI and SWMM 5 console program.

```
//-----  
// Computed node quantities  
//-----  
#define MAX_NODE_RESULTS 7  
enum NodeResultType {  
    NODE_DEPTH,           // water depth above invert  
    NODE_HEAD,            // hydraulic head  
    NODE_VOLUME,          // volume stored & ponded  
    NODE_LATFLOW,         // lateral inflow rate  
    NODE_INFLOW,          // total inflow rate  
    NODE_OVERFLOW,        // overflow rate  
    NODE_QUAL;            // concentration of each pollutant  
  
//-----  
// Computed link quantities  
//-----  
#define MAX_LINK_RESULTS 6  
enum LinkResultType {  
    LINK_FLOW,            // flow rate  
    LINK_DEPTH,           // flow depth  
    LINK_VELOCITY,        // flow velocity  
    LINK_VOLUME,          // link volume  
    LINK_CAPACITY,        // ratio of area to full area  
    LINK_QUAL;            // concentration of each pollutant  
  
-----
```

From: SWMM-USERS On Behalf Of Jiada Li
Sent: Thursday, March 28, 2019 01:37 AM [UTC]
Subject: TSS simulation

Hi Robert:

Thanks.

Basically, I use PySWMM to execute SWMM simulation. The .rpt file and .out file will be updated after I run it. However, as you respond, the .rpt file doesn't contain all the information of SWMM GUI output. For instance, after PySWMM simulation, I got the new .rpt file but it only gives me link TSS load summary. However, I also need TSS concentration of links and nodes. From your saying, .out file includes such info?

From: SWMM-USERS On Behalf Of Robert Dickinson
Sent: Thursday, March 28, 2019 12:49 AM [UTC]
Subject: TSS simulation

Hello Jiada,

I was just looking at your EPANET paper and your Github and it finally dawned on me that you use a lot of tools to run your simulations. One of which may be the SWMM5 GUI.

If you use the SWMM5 Delphi GUI to run a simulation there will be a text .rpt file and a binary .out file made for the simulation. The .out file can be used by R and Python readers to make output tables. There are also .out to CSV file tools on various Github's.

The .rpt file is text and has the input data echo, mass balance tables and summary output tables. The SWMM5 GUI using the menu tool Report/Status will show you the input data echo and mass balance tables but hide the summary tables. You use Report/Summary to see the Summary Tables.

If you close SWMM5 then you can use a text editor to see the whole .rpt file and copy and paste. There is not tool or menu item in the GUI to load the mass balance tables - another good suggestion from you for future improvements.

Regards,
Robert Dickinson
Innovyze Inc.

From: SWMM-USERS On Behalf Of Robert Dickinson
Sent: Wednesday, March 27, 2019 04:00 AM [UTC]
Subject: TSS simulation

Final stored is the final mass in the network including links and nodes.
The table is from the rot file - you can find it under the menu item Status

From: SWMM-USERS On Behalf Of Jiada Li
Sent: Wednesday, March 27, 2019 01:07 AM [UTC]
Subject: TSS simulation

Hi Robert:

Thanks. In the first table, so the 'final stored Mass' is the final sum of all links' TSS? or the final sum of TSS existing in the system?

By the way, how did you upload your .rpt table? I didn't find any tabs to upload documents.

From: SWMM-USERS On Behalf Of Robert Dickinson
Sent: Tuesday, March 26, 2019 05:23 PM [UTC]
Subject: TSS simulation

Here is a better link

<https://swmm5.org/2017/04/26/pdf-links-for-swmm5-swmm4-swmm3/>

From: SWMM-USERS On Behalf Of Robert Dickinson
Sent: Tuesday, March 26, 2019 05:22 PM [UTC]
Subject: TSS simulation

Here is an example output for water quality table for mass balance in the report file. The final stored mass is the load from the subcatchments that is still in the network and has not either flooded, gone out an outfall or been decayed or treated in the network.

*****	COD	TOTSOL	TOTNIT	TSS	PO4
Quality Routing Continuity	lbs	lbs	lbs	lbs	lbs
*****	-----	-----	-----	-----	-----
Dry Weather Inflow	0.000	0.000	0.000	0.000	0.000
Wet Weather Inflow	3863.532	6584.492	36.286	13415.943	49.768
Groundwater Inflow	0.000	0.000	0.000	0.000	0.000
RDII Inflow	0.000	0.000	0.000	0.000	0.000
External Inflow	0.000	0.000	0.000	0.000	0.000
External Outflow	2438.324	3766.509	19.867	11298.100	28.179
Flooding Loss	335.659	720.461	4.387	4.856	5.407
Exfiltration Loss	0.000	0.000	0.000	0.000	0.000
Mass Reacted	1162.203	2000.426	11.075	2077.134	15.148
Initial Stored Mass	0.000	0.000	0.000	0.000	0.000
Final Stored Mass	2.233	5.092	0.032	0.656	0.038
Continuity Error (%)	-1.938	1.397	2.550	0.262	2.002

Here is the other table that applies to your question(s). It shows the buildup and Surface Runoff (Washoff).

*****	COD	TOTSOL	TOTNIT	TSS	PO4
Runoff Quality Continuity	lbs	lbs	lbs	lbs	lbs
*****	-----	-----	-----	-----	-----

Initial Buildup	5056.849	13379.165	125.370	13379.165	103.603
Surface Buildup	22.568	94.521	0.384	23.242	0.296
Wet Deposition	27.864	27.864	1.672	27.864	0.011
Sweeping Removal	0.000	0.000	0.000	0.000	0.000
Infiltration Loss	13.598	13.598	0.816	13.598	0.005
BMP Removal	0.000	0.000	0.000	0.000	0.000
Surface Runoff	3886.558	6618.216	36.453	13415.987	50.032
Remaining Buildup	1207.071	6869.682	90.154	0.632	53.872
Continuity Error (%)	0.001	0.000	0.003	0.000	0.000

I have not checked the SWMM3 code recently but essentially this table is how Wayne Huber of UF and OSU designed the buildup/washoff equation output back in 1980 for SWMM3. I have a copy of his Nato Water Quality chapters here (not the greatest PDF copy) If you want more of the original theory on buildup/washoff
<https://swmm5.org/2017/04/26/pdf-links-for-swmm5-swmm4-swmm3/>

 From: SWMM-USERS On Behalf Of Jiada Li
 Sent: Tuesday, March 26, 2019 04:11 PM [UTC]
 Subject: TSS simulation

Hi Rober:

1. Yes. You're right. I missed the load from upstream links.
2. let's close this question.
3. so the summary load is the total load of the entire simulation? Is the summary load the final load exists in the link at end of timestep?
4. close

 From: SWMM-USERS On Behalf Of Robert Dickinson
 Sent: Tuesday, March 26, 2019 04:06 PM [UTC]
 Subject: TSS simulation

Hello Jiada,
 A few comments:

1. Is it true that the TSS load of each node is equal to the sum of subcatchments' washed-off TSS load? Me: It may include the load from upstream links.
2. Ok. so, the TSS of SWMM 'table' is concentration. The time-series of TSS can be calculated by multiplying the node total inflow and concentration. In this way, we can get the TSS time-series for node, link, and sub-catchment. Is that correct? Yes
3. Alright, but in the 'Summary Results', can I say this TSS load of a link is the sum of time-series TSS calculated by multiplying the link flow and concentration? The load you see is integrated by the engine to give you the summary load.
4. Yep. I only have one outfall in my model. so I can also use the TSS load of the link connected to the outfall to represent that outfall's TSS load. I found they are same. Thanks Yes.

 From: SWMM-USERS On Behalf Of Jiada Li
 Sent: Tuesday, March 26, 2019 04:00 PM [UTC]
 Subject: TSS simulation

Hi Robert:

1. Is it true that the TSS load of each node is equal to the sum of subcatchments' washed-off TSS load?
2. Ok. so, the TSS of SWMM 'table' is concentration. The time-series of TSS can be calculated by multiplying the node total inflow and concentration. In this way, we can get the TSS time-series for node, link, and sub-catchment. Is that correct?
3. Alright, but in the 'Summary Results', can I say this TSS load of a link is the sum of time-series TSS calculated by multiplying the link flow and concentration?
4. Yep. I only have one outfall in my model. so I can also use the TSS load of the link connected to the outfall to represent that outfall's TSS load. I found they are same. Thanks

 From: SWMM-USERS On Behalf Of Robert Dickinson
 Sent: Tuesday, March 26, 2019 12:39 AM [UTC]
 Subject: TSS simulation

Hello Jiada,

1. Of outfall TSS load, link TSS load, and subcatchment washed off TSS, I can find the definitions for these three variables, but what are the relationships among them? Is the sum of upstream washed-off TSS equal to downstream directly connected link's TSS? An answer: The Subcatchment load drains to the outlet node of the Subcatchment, the Outfall TSS Load is the sum of the load (flow * concentration) from the link connected to the outfall - remember in SWMM5 there is only one Link to an Outfall. The link load is the load from the upstream node of the link minus any 1st order decay and CSTR effects in the link.
2. Why there is no output of node TSS load? I found one to compute it, The method is using 'statistics' to get the TSS for each node. However, it only gives me the mean and peak value. What if I need the time-series nodal TSS load, how should I do? An answer: Use the SWMM5 Table and make a table of the total flow and concentration at the node. Use Excel to calculate the time series load. Maybe a future version of SWMM5 can have a node table as well as a link table.
3. Following by question 2, how to get the time-series TSS load for links, sub catchments, and outfalls? An answer: Use the SWMM5 Table and make a table of the total flow and concentration at the link and outfall and use Excel or Python or R.
4. For outfall TSS load, link TSS load, and subcatchment washed off TSS, which is better to be considered as an indicator for pollutant reduction in a system-level scale? An Answer: The outfall load is a better indicator of pollutant reduction. The sum of all of the outfall loads is the best. I hope this helps.

Regards,
Robert Dickinson
Innovyze Inc.

From: SWMM-USERS On Behalf Of Jiada Li
Sent: Tuesday, March 26, 2019 12:16 AM [UTC]
Subject: TSS simulation

I got some questions when I'm simulating TSS:

- 1) Of outfall TSS load, link TSS load, and subcatchment washed off TSS, I can find the definitions for these three variables, but what are the relationships among them? Is the sum of upstream washed-off TSS equal to downstream directly connected link's TSS?
- 2) Why there is no output of node TSS load? I found one to compute it, The method is using 'statistics' to get the TSS for each node. However, it only gives me the mean and peak value. What if I need the time-series nodal TSS load, how should I do?
- 3) Following by question 2, how to get the time-series TSS load for links, sub catchments, and outfalls?
- 4) For outfall TSS load, link TSS load, and subcatchment washed off TSS, which is better to be considered as an indicator for pollutant reduction in a system-level scale?

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